platform in rough weather, and that to obtain the necessary strength the weight would become excessive.

Practically the carrying part of the structure rests on six floating vessels coupled together by a framework. It does not follow that because this principle as applied to the lightly-constructed canoes used by the natives of the Polynesian Islands is successful, that it could therefore be applied to the enormous structure required for an Atlantic liner. The *Calais Douvre* and other coupled boats which have been built for the cross-Channel passage, have certainly not proved a success.

M. Bazin, the inventor, is an engineer well known in France for the originality of his ideas, and for the invention of a submarine machine that served for the attempt to raise the Spanish galleons sunk in Vigo Bay; also for inventions in connection with gold-washing machinery, dredgers, cranes, &c. His roller-boat will no doubt attract a great deal of attention when it arrives in the Thames.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The degree of Doctor of Science will be conferred on Dr. Nansen at a special congregation to be held at 1 p.m. on March 16.

Prof. E. E. Barnard, of the Yerkes Observatory, Chicago, is to exhibit his photographs of the Milky Way, and other celestial objects, in the Lecture Theatre of the Cavendish Laboratory, at 4 p.m. on February 20.

Dr. A. C. Haddon is this term giving two well-attended classes (one elementary and one advanced) in physical anthropology at the Anatomy School.

An examination for scholarships and exhibitions in natural science and engineering will be held at Trinity College on March 15. Details may be learned on application to the tutors.

THE Cornwall County Council have had to further increase the salary attached to the lectureship on fisheries to £350 per annum, to enable them to secure a competent instructor.

AT a meeting of the Council of the Royal College of Surgeons, on Saturday last, the following resolution was adopted (subject to the approval of the Royal College of Physicians): "That the Royal College of Physicians of London and the Royal College of Surgeons of England, in full accord with their previous action, express the earnest desire that her Majesty's Government will, at the earliest opportunity, reintroduce a Bill for the reconstitution of the London University by statutory commission on the general lines of the report of the Cowper Commission, and do assure the Government that such a course will have their approval and support." It was further resolved that if the Royal College of Physicians adopted the foregoing resolution, copies of it should be forthwith forwarded to the Lord President of the Council, Mr. Balfour, and the Senate of the University of London.

A PLEA for the establishment of a National University at Washington is made in *Science* of February 5. It is suggested that the University should be developed from the national institutions already existing at Washington. "Workers in the different Government divisions and others having the proper preliminary education could, on presenting a thesis showing original work and passing an examination, receive the doctorate of philosophy, and this would qualify them as a civil service examination for promotion. The present Commissioner of Education, and perhaps the Regents of the Smithsonian Institution, could govern the University. Examiners could be appointed from leading representatives of science and learning, who would meet yearly for a week of convocation in Washington. We believe that, without radical changes, and with nominal expense, there could be established at Washington a National University likely to become the world's greatest University."

AN annual report, received a few days ago, tells us that the past year was more than usually interesting in the history of the Glasgow and West of Scotland Technical College, as being the centenary of the foundation of Anderson's College, which received its charter of incorporation from the magistrates of the City of Glasgow on June 9, 1796. Besides being the oldest member of this composite institution, the interest attaching to Anderson's College—apart from the fame of its medical school, now a separate institution—lies in the fact that it was the progenitor of mechanics' institutions and the pioneer of technical education in this country. The record of successes of past and present students testifies to the soundness of the instruction given. The College is extending its operations rapidly over the West of Scotland, and, as its name implies, it is now more than a Glasgow institution. We notice that Mr. G. F. Scott Elliot has been appointed lecturer in botany, in succession to the late Mr. Thomas King, who occupied that position for many years.

THE fifth annual report of the Technical Instruction Subcommittee of the City of Liverpool, which has reached us, shows that the high standard of efficiency was maintained during 1896. Most educationists will agree with the Chairman, who says, in his prefatory remarks, that "it will be a considerable advantage to the cause of higher education generally when it is recognised, by legislative authority, that specialised technical instruction can only properly be carried on as part of a general scheme of secondary education, and when means are provided for encouraging and developing general secondary education without attempting to force it too soon towards specialisation." The detailed report of the Director shows that no part of the legitimate work of a local system of technical instruction has been neglected. The teaching of science and modern languages has been further improved and developed in the secondary schools, special attention being very properly directed towards the provision of every convenience for the necessary amount of practical instruction in chemistry and physics. Side by side with this provision for young boys and girls, we find an efficient system of evening classes in commercial and technical subjects for young men who have started upon the serious work of life. The Committee have shown their appreciation of their good fortune in having a University College at hand by helping it to the extent of £1700 during the past year, which has been marked by a much needed extension of the chemical laboratories, and by the establishment of a new Natural History Museum.

SCIENTIFIC SERIALS.

Bulletin of the American Mathematical Society, January.—"On the stability of a sleeping top" is the abstract of a lecture delivered by Prof. Klein before the Society at the Princeton meeting, October 17, 1896. It will be remembered that Prof. Klein delivered four lectures "On the theory of the top," at the sesquicentennial celebration of the University. In these latter an attempt was made to simplify the formulæ for the motion of a top by turning to account the methods of the modern theory of functions. The later lecture before us considers from the same standpoint a much more elementary question, viz. the stability of a top rotating about an axis directed vertically upwards. The point of support is supposed to be fixed. When the rotation is very rapid the behaviour of the top is as if its axis were held fixed by a special force. Some interesting results are arrived at.—Bibliography of surfaces and twisted curves, by Dr. J. E. Hill, consists mainly of extracts from a paper read before the Society in May last. It attempts to represent a compilation and classification of all articles, with certain exceptions, upon these surfaces and curves which have been published during the present century. The paper itself should be, judging from these extracts, extremely useful to students.—Linear differential equations is a review, by Prof. M. Bôcher, of Schlesinger's "Handbuch der Theorie der Linearen Differentialgleichungen," and, like the previous work by Prof. Bôcher in the *Bulletin*, is thorough. The writer's conclusion is that though the book fails to meet some of the demands which it seems to him may fairly be made of a handbook, it is certain to fill an important place in a mathematical library, owing to the great amount of information which it contains in accessible form.—Messrs. R. W. Willson and B. O. Peirce furnish a table of the first forty roots of the Bessel equation $J_0(x) = 0$ with the corresponding values of $J_1(x)$. This is a paper which was presented to the Society at its summer meeting, September 1, 1896.—The final article, not counting the notes and publications, is entitled "Notes on the Theory of Bilinear Forms," and is by Prof. H. Taber. It was read at the November meeting.

Wiedemann's Annalen der Physik und Chemie, No. 2.—On the dissipation of electricity from a conductor into the air, and on the influence exerted by an increase of temperature of the conductor upon this process, by A. Oberbeck. A thin wire, to which an electric charge is imparted, loses its charge more

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readily in air when hot than when cold. The difference between a positive and a negative charge is also more strongly marked at high temperatures, the negative charge being more rapidly dissipated.—Point discharge potentials in air and hydrogen, by K. Wesendonck. The quantity of negative electricity discharged into hydrogen is greater than the quantity of positive electricity discharged at the same potential, but the initial discharge potentials are not necessarily different.—The atomic theory in natural science, by L. Boltzmann. The conception of the atom cannot be finally superseded by the differential equation as applied to a *continuum*, since the latter is itself based ultimately upon the conception of a discrete structure, even in such applications as Fourier's theory of thermal conductivity. The atom has also the advantage of greater immediate clearness and picturesqueness over the differential equation, whether it really exists or not.—On discharge rays, and their relation to kathode and Röntgen rays, by M. W. Hoffmann. Discharge rays are contained in the spark discharge in air, hydrogen, and nitrogen at ordinary or low pressures. They exert no photographic action, but may be discovered by their property of imparting luminescence to solid solutions of manganese sulphate in gypsum when heated to a temperature below incandescence (thermo-luminescence). They are intercepted by mica, quartz, fluorspar, and other solids, unless produced at low pressures. They proceed in straight lines, and are not deflected by a magnet. They differ from ultra-violet light in their power of penetrating air, and not fluorspar. They are not reflected by solids.—Platinised electrodes and determinations of resistance, by F. Kohlrausch. The solution used by Lummer and Kurlbaum for making bolometers, viz. one part platinum chloride, to 0·008 lead acetate and 30 water, gives a platinum black, which is very useful for platinising electrodes. It facilitates the use of smaller electrodes for alternate-current resistance measurements, and gives a well-marked minimum of telephone effect.—Electric moment of tourmaline, by W. Voigt. This was determined by breaking the tourmaline into fragments, and was found to be 33·4 C.G.S. units.—A new formula for spectrum waves, by J. J. Balmer. The author substitutes for the infinite geometrical progression in Kayser and Runge's formula a closed term, and gives the frequencies for the lines of each series in the form $A - B/(n+c)^2$.

SOCIETIES AND ACADEMIES.

London.

Royal Society, January 21.—"On Reciprocal Innervation of Antagonistic Muscles." Third Note. By C. S. Sherrington, F.R.S., Holt Professor of Physiology, University College, Liverpool. Received December 29, 1896.

If transection of the neural axis be carried out at the level of the crura cerebri in, *e.g.* the cat, there ensues after a somewhat variable interval of time a tonic rigidity in certain groups of skeletal muscles, especially in those of the dorsal aspect of the neck and tail and of the extensor surfaces of the limbs. The details of this condition, although of some interest, it is unnecessary to describe here and now, except in so far as the extensors of the elbow and the knee are concerned. These latter affect the present subject. The extensors of the elbow and the knee are generally in strong contraction, but altogether without tremor and with no marked relaxations or exacerbations. On taking hold of the limbs and attempting to forcibly flex the elbow or knee a very considerable degree indeed of resistance is experienced, the triceps brachii and quadriceps extensor cruris become under the stretch which the more or less effectual flexion puts upon them, still tenser than before, and on releasing the limb the joints spring back forthwith to their previous attitude of full extension. Despite, however, this powerful extensor rigidity, flexion of the elbow may be at once obtained with perfect facility by simply stimulating the toes or pad of the fore foot. When this is done the triceps enters into relaxation and the biceps passes into contraction. If, when the reflex is evolved, the condition of the triceps muscle is carefully examined, its contraction is found to undergo inhibition, and its tenseness to be broken down synchronously with and indeed very often accurately at the very moment of onset of reflex contraction in the opponent prebrachial muscles. The reaction can be initiated in more ways than one, electrical excitation of a digital nerve or mechanical excitation of the sensory root of any of the upper cervical nerves may be employed; I have seen on one occasion a rubbing of the skin of the cheek of the same side effective.

Similarly in the case of the hind limb. The extensor muscles of the knee exhibit strong steady non-tremulent contraction under the appropriate conditions of experiment. The application of hot water to the hind foot then elicits, nevertheless, an immediate flexion at knee and hip, during which not only are the flexors of those joints thrown into contraction, but the extensors of the knee joint are simultaneously *relaxed*. Electric excitation of a digital nerve or of the internal saphenous nerve anywhere along its course will also initiate the reflex.

January 28.—"On the Capacity and Residual Charge of Dielectrics as affected by Temperature and Time." By J. Hopkinson, F.R.S., and E. Wilson. Received December 15, 1896.

The major portion of the experiments described in this paper have been made on window glass and ice. It is shown that for long times residual charge diminishes with rise of temperature in the case of glass, but for short times it increases both for glass and ice. The capacity of glass when measured for ordinary durations of time, such as 1/100th to 1/10th second, increases much with rise of temperature, but when measured for short periods, such as $1/10^6$ second, it does not sensibly increase. The difference is shown to be due to the residual charge which comes out between 1/50,000th second and 1/100th second. The capacity of ice when measured for periods of 1/100th to 1/10th second increases both with rise of temperature and with increase of time; its value is of the order of 80, but when measured for periods such as $1/10^6$ second, its value is less than 3. The difference again is due to residual charge coming out during short times. In the case of glass, conductivity has been observed at fairly high temperatures and after short times of electrification; it is found that the conductivity after 1/50,000th second electrification is much greater than after 1/10,000th, but for longer times is sensibly constant. Thus a continuity is shown between the conduction in dielectrics which exhibit residual charge and deviation from Maxwell's law and ordinary electrolytes.

February 4.—"On the Gases enclosed in Crystalline Rocks and Minerals." By Prof. W. A. Tilden, F.R.S.

From the time of Sir Humphry Davy it has been known that many minerals contain gases as well as liquids enclosed in cavities, which are often large enough to be visible to the unaided eye. The liquid sometimes consists of water or saline solutions, occasionally of mineral naphtha, and not unfrequently of carbon dioxide, which is recognisable by its great expansibility and total disappearance when the temperature is raised to about 31° C.

The presence of gases other than nitrogen and carbon dioxide in natural crystals had not been observed, save in one or two isolated cases, until two years ago, when helium was discovered in certain minerals by Ramsay.

In the course of experiments undertaken with the object of ascertaining, if possible, the condition in which this element, remarkable for its chemical inactivity, is contained in these minerals, I was led to the observation that granite when heated in a vacuum gives off several times its volume of gas, which is combustible, and which consists largely of hydrogen and carbonic oxide. I now find that these two gases are contained, more or less abundantly, in all the crystalline rocks, and, together with carbon dioxide and small quantities of nitrogen and marsh gas, are apparently enclosed in fine cavities which permeate the crystals of quartz, felspar, and other mineral constituents.

Of twenty different rocks examined—granite, gneiss, gabbro, schist, or basalt of different geological ages and from widely different localities—all yielded gas in which hydrogen is present, and is usually the preponderant ingredient of the mixture. The total bulk of the gases extracted, varied from a volume equal to 1·3 times the volume of the rock to 17·8 times its volume. Lava also gave gas, though in smaller quantity, and this also contained hydrogen. Graphite, quartz, beryl and tinstone, as examples of definite minerals associated with the older rocks, gave a similar result.

To account for the large proportion of hydrogen and carbonic oxide in these gases, we must suppose that the rock enclosing them was crystallised in an atmosphere rich in carbon dioxide and steam, at the same time in contact with some easily oxidisable substance, probably a metal or metallic carbide, at a moderately high temperature. No free oxygen has been found in any

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